

ภาคผนวก 2

2.12 เอกสารสอบเทียบเครื่องมือตรวจวัด

Certificate of Calibration

Certificate No. : 67-200134-1

Page : 1 of 2

Submitted by : HVE Co.,Ltd.

603 Soi Jarunsanitwong 46, Jarunsanitwong Road, Bangyeekun, Bangplad, Bangkok 10700

Equipment : Electronic Balance

Manufacturer : SHIMADZU **Model :** AX200

Serial No. : D432620040 **ID No. :** 114

Capacity : 200 g **Resolution :** 0.0001 g

Environment : On site calibration was carried out at the Laboratory, HVE Co., Ltd.

Ambient Temperature : (30.8 to 31.6) °C

Relative Humidity : (50.4 to 53.4) %

Air Pressure : 1008.0 mbar

Date of Received : 17 April 2024

Date of Calibration : 17 April 2024

Date of Issue : 24 April 2024

Calibrated by : Akaradath Thippichai

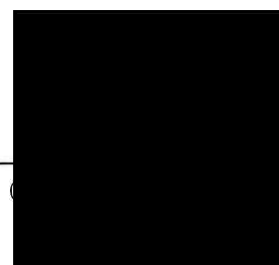
Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 7 - November 2022

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02232088	08 Nov 2024	National Institute of Metrology (Thailand), (NIMT)

Approved by :



The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-200134-1

Page : 2 of 2

Result of Calibration : After Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty $\pm$ (g)	Error before Adjustment (g)
0.01	0.0000	0.00012	0.0000
0.1	0.0000	0.00012	0.0000
0.5	0.0000	0.00013	0.0000
1	-0.0001	0.00013	0.0000
10	0.0000	0.00013	-0.0002
20	0.0000	0.00014	-0.0003
50	0.0001	0.00015	-0.0004
100	0.0001	0.00020	-0.0007
150	0.0002	0.00038	-0.0014
200	0.0005	0.00038	-0.0019

This result of calibration was found accurate as shown on date and place of calibration only.

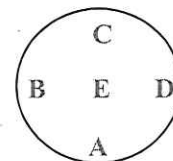
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.06$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A B C D E

0.0003 -0.0006 -0.0003 0.0006 0.0000 g



Repeatability

Load test : 200 g

Stdev. : 0.00005 g

- o o o -

ABJ



Certificate No. C17240065

Calibration Certificate

Equipment:	Oven	Job No.:	KSMT2400663
Model:	UNB 500	Received Date:	01 April 2024
Serial No.(or ID):	C507.1007 (012)	Issued Date:	03 April 2024
Manufacturer:	Memmert	Page:	1 of 4
Condition:	In Condition		
Ventilation Valve:	Closed	Shelves(pc.):	2

Customer

HVE Co., Ltd.
603 Soi Charansanitwong 46, Charansanitwong Road Bang Yi Khan, Bang Phlat, Bangkok 10700

Calibration Place

HVE Co., Ltd. (Laboratory)
603 Soi Charansanitwong 46, Charansanitwong Road Bang Yi Khan, Bang Phlat, Bangkok 10700

Calibration Date

01 April 2024

Environment Condition

Temperature: 30.1 °C ± 1.3 °C
Humidity: 60.9 %RH ± 3.3 %RH

The Method used

In-house method, WI17, based on TLAS-G20

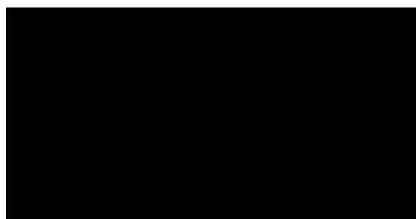
Traceability

This certificate is traceable to the SI Units maintained by
National Institute of Metrology (NIMT), Thailand through
Quality Reborn Co.,Ltd.Certificate No. QR23-1906

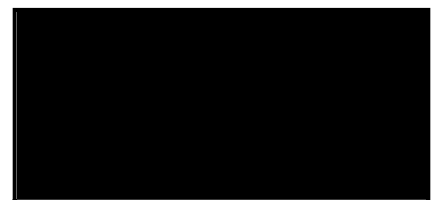
This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

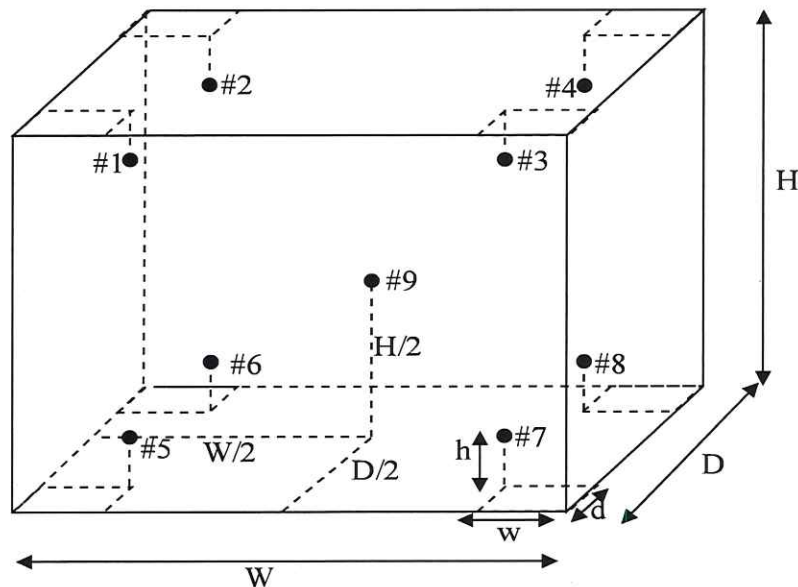
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SCIMET Co., Ltd.



Person in charge



Authorized signatory



Standard Installation Locations

Volume (Calibration Zone)= 6 (Liters)

Inside chamber: $W = 56$ (cm) $D = 40$ (cm) $H = 48$ (cm)

Standard Locations (#1, #2, #3, #4): $w = 20$ (cm) $d = 10$ (cm) $h = 15$ (cm)

Standard Locations (#5, #6, #7, #8): $w = 20$ (cm) $d = 10$ (cm) $h = 15$ (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

Calibration Results:

Pre-Calibration

Desired	Setting	Indicating	#1	#2	#3	#4	#5	#6	#7	#8	#9
104.0	104.0	104.0	103.23	103.17	103.10	103.10	101.81	101.68	101.89	101.61	102.51

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 105.5 °C

Locations	Measured Temperature (°C)	Correction (°C)	Uncertainty (± °C)
#1	104.48	0.48	0.39
#2	104.51	0.51	0.39
#3	104.43	0.43	0.39
#4	104.45	0.45	0.39
#5	103.20	-0.80	0.39
#6	103.11	-0.89	0.39
#7	103.27	-0.73	0.39
#8	103.07	-0.93	0.39
#9	103.87	-0.13	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	105.5	105.5	104.48	104.51	104.43	104.45	103.20	103.11	103.27	103.07	103.87	0.39

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
105.5	0.89	0.12	1.64

Note: * Maximum uncertainty of the each position

Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 182.0 °C

Locations	Measured Temperature (°C)	Correction (°C)	Uncertainty (± °C)
#1	181.05	1.05	0.49
#2	181.24	1.24	0.49
#3	180.99	0.99	0.49
#4	181.18	1.18	0.49
#5	179.64	-0.36	0.50
#6	179.63	-0.37	0.51
#7	179.84	-0.16	0.50
#8	180.00	0.00	0.50
#9	180.18	0.18	0.50

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	182.0	182.0	181.05	181.24	180.99	181.18	179.64	179.63	179.84	180.00	180.18	0.51

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
182.0	1.17	0.16	1.83

Note: * Maximum uncertainty of the each position

The End of Certificate

Statements of conformity:

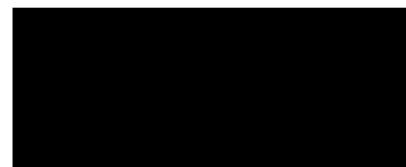
This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :**
- ☐ Choice A Binary Statement for Simple Acceptance Rule ($w = 0$), Specific Risk $< 50\%$ PFA.
 - ☒ Choice B Non-binary statement with guard band ($w = 1 U$), Pass or Fail Specific Risk $< 2.5\%$ PFA and Condition Pass or Condition Fail Specific Risk $< 50\%$ PFA.
 - ☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band ($w = r U$).
- ; PFA: Probability of False Accept



Authorized signatory

Without adjustment

Desired Temperature : 104.0°C

Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 105.5 °C

Locations	Measured (°C)	Correction of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	104.48	0.48	0.39	1.0	Pass
#2	104.51	0.51	0.39	1.0	Pass
#3	104.43	0.43	0.39	1.0	Pass
#4	104.45	0.45	0.39	1.0	Pass
#5	103.20	-0.80	0.39	1.0	Condition Pass
#6	103.11	-0.89	0.39	1.0	Condition Pass
#7	103.27	-0.73	0.39	1.0	Condition Pass
#8	103.07	-0.93	0.39	1.0	Condition Pass
#9	103.87	-0.13	0.39	1.0	Pass

Correction of UUC.* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

Statements of conformity:(Cont.)

Without adjustment (Cont.)

Desired Temperature : 180.0°C

Tolerances : 2 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 182.0 °C

Locations	Measured (°C)	Correction of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	181.05	1.05	0.49	2	Pass
#2	181.24	1.24	0.49	2	Pass
#3	180.99	0.99	0.49	2	Pass
#4	181.18	1.18	0.49	2	Pass
#5	179.64	-0.36	0.50	2	Pass
#6	179.63	-0.37	0.51	2	Pass
#7	179.84	-0.16	0.50	2	Pass
#8	180.00	0.00	0.50	2	Pass
#9	180.18	0.18	0.50	2	Pass

Correction of UUC.* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

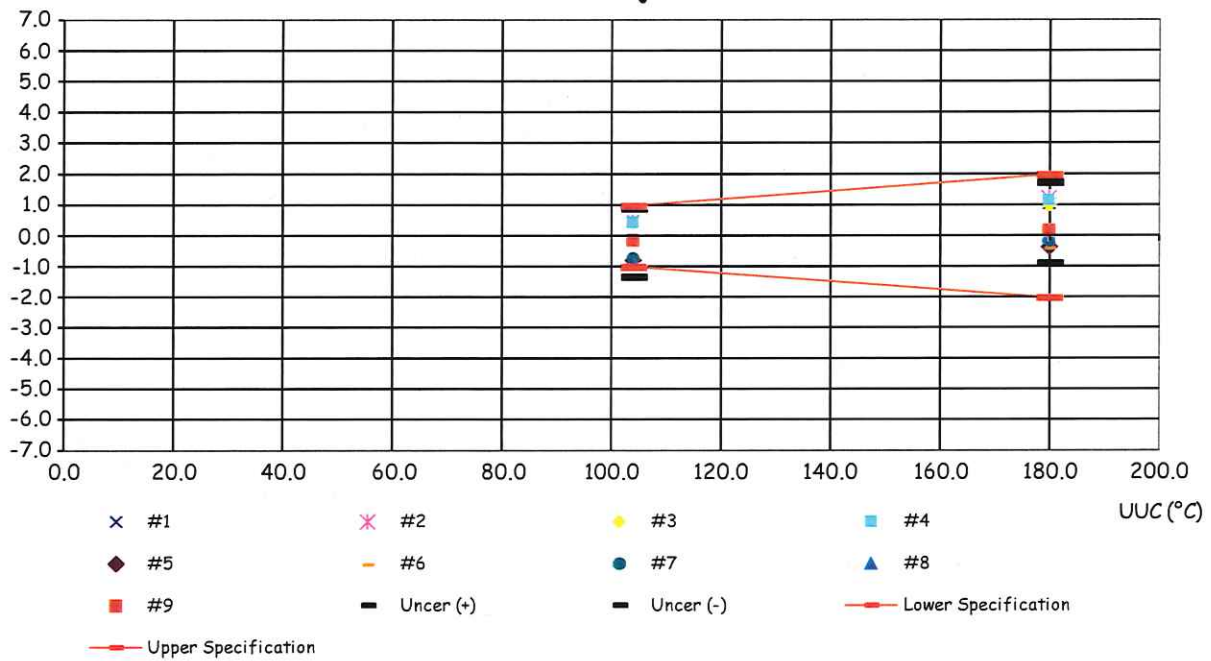
The End of Statements of Conformity

Corr_Distribution & Max_Measurement Uncertainty

Job_No. KSMT2400663

Without adjustment

Correction (°C)

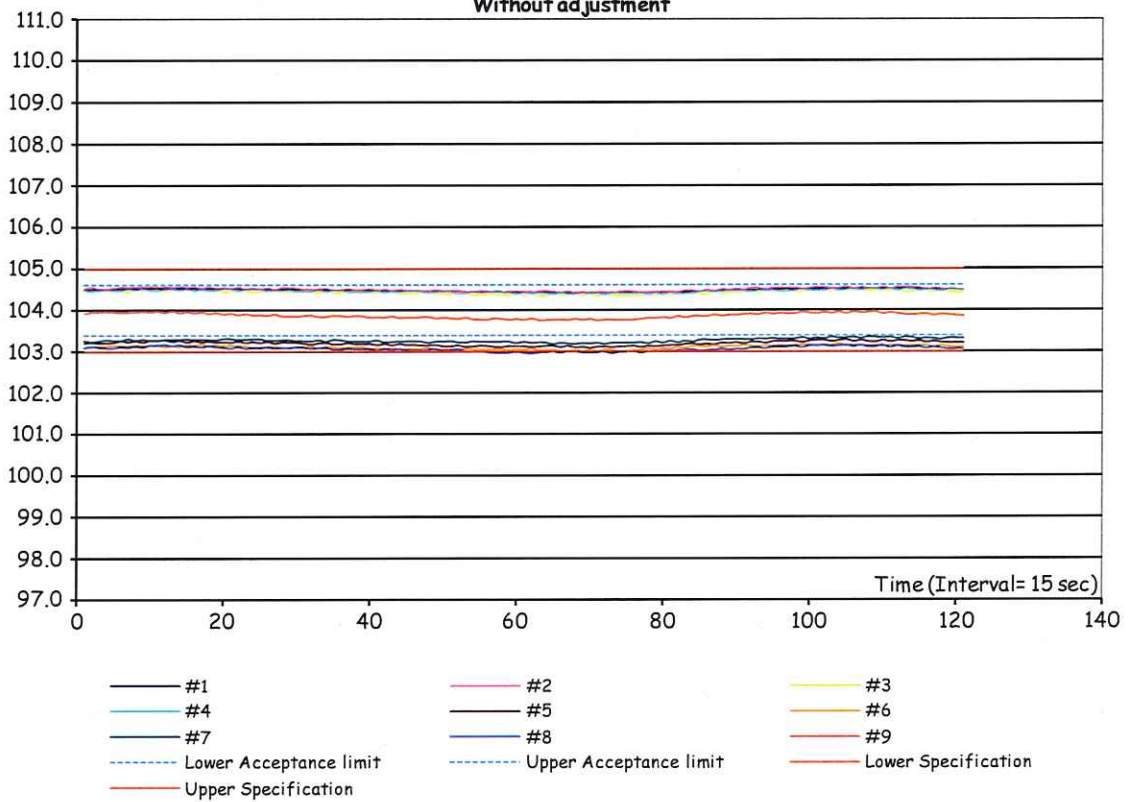


Temperature Distribution @ 104.0°C

Job_No. KSMT2400663

Without adjustment

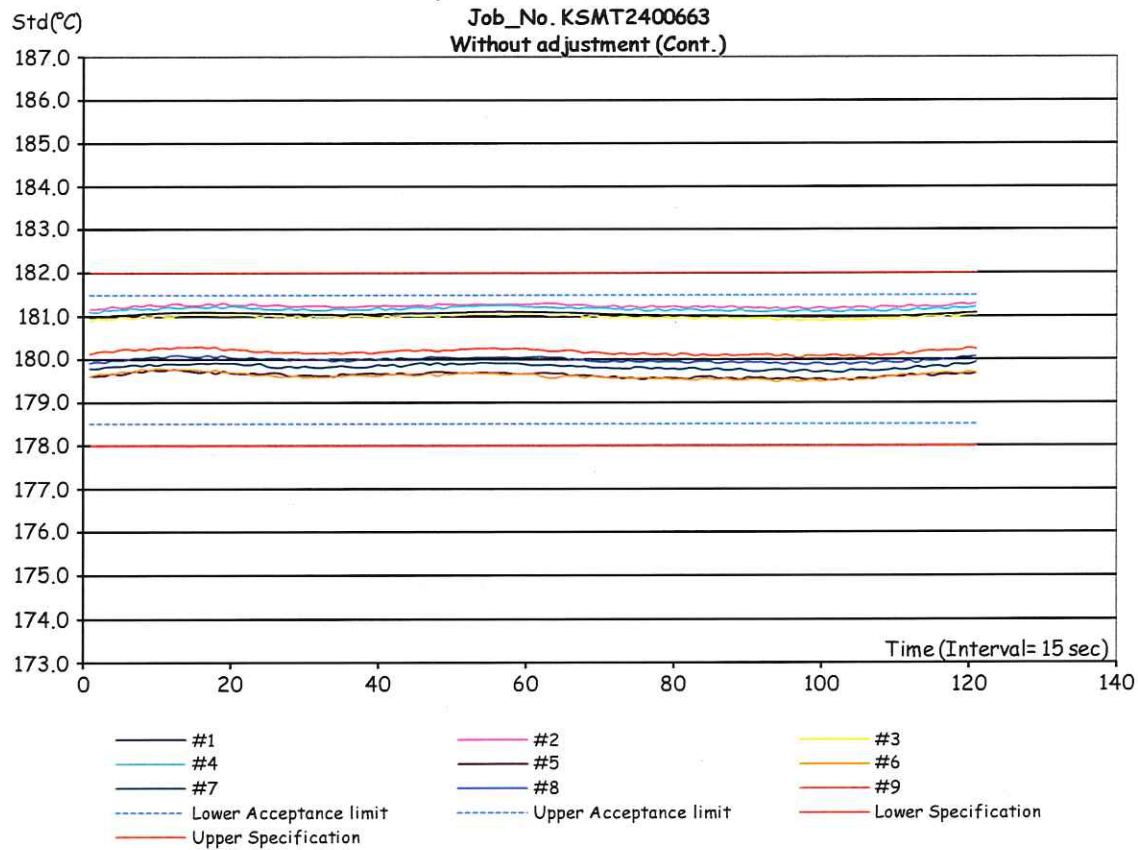
Std(°C)



Temperature Distribution @ 180.0°C

Job_No. KSMT2400663

Without adjustment (Cont.)





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSMT2400663

ชนิดเครื่องมือ: Oven

รุ่น: UNB 500

หมายเลขเครื่อง: C507.1007 (012)

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
01 Apr 2024			01 Apr 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☒	☐	1. สายไฟ	☒	☐	
☒	☐	2. การทำงาน Main Switch	☒	☐	
☒	☐	3. การทำงาน Selector Key	☒	☐	
☒	☐	4. การแสดงผล Display	☒	☐	
☐	☐	5. การทำงาน พัดลม	☐	☐	ไม่มี
☒	☐	6. สภาพ Lever of Ventilation valve	☒	☐	
☒	☐	7. สภาพ Lever door open / close	☒	☐	
☒	☐	8. สภาพ Door seal	☒	☐	
☒	☐	9. การทำงานของระบบ Safety	☒	☐	
☐	☐	10. การทำงานของระบบทำความเย็น	☐	☐	ไม่มี
☐	☐	11. การทำงานของระบบทำความชื้น	☐	☐	ไม่มี
☒	☐	12. สภาพตัวเครื่อง	☒	☐	
☒	☐	13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	☒	☐	

ข้อแนะนำ :

Mr. Hattapong Pumnil

Service Engineer

บริษัท ชายนีเมท จำกัด (SCIMET CO., LTD.)

1194 Soi Wachirathamsathit 57, Bangchak, Phrakhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 02 460 9239

FI17-00: 08 MAR 2023

Certificate of Calibration

Certificate No. : 67-400216-6

Page : 1 of 2

Submitted by : HVE Co., Ltd.

603 Soi Jarunsanitwong 46, Jarunsanitwong Road, Bangyeekun, Bangplad, Bangkok 10700

Equipment : Temperature controlled enclosure (Incubator)

Manufacturer : Lovibond

Model : ET636-6

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 9982523-03

ID No. : 011

Environment : On site calibration was carried out at the Laboratory, HVE Co., Ltd.

Ambient Temperature : (27.0 to 28.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (229.0 to 230.0) V

Date of Received : 17 April 2024

Date of Calibration : 18 April 2024

Date of Issue : 19 April 2024

Calibrated by : Kittisak Kokaeo

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with RTD Probe

ID No.	Cert. No.	Due Date	Traceability
400046 & 400047	67-400047-2	26 Jul 2024	National Institute of Metrology Thailand (NIMT)

Approved by

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400216-6

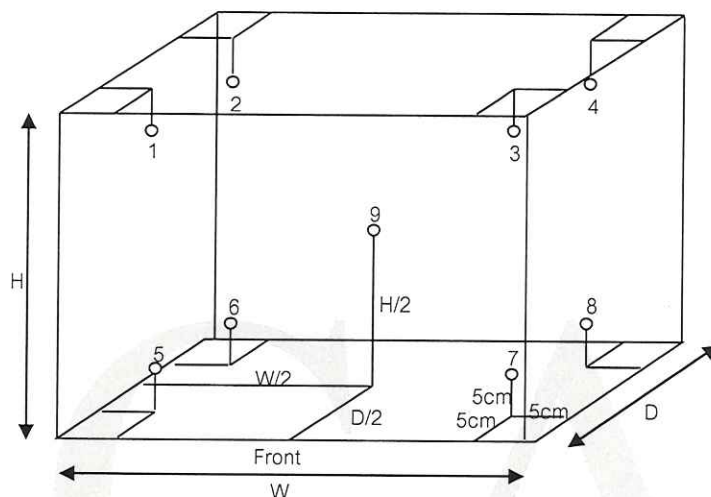
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.53 m

D = 0.43 m

H = 1.40 m

Capacity = 0.32 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
20.0	21.0	21.0	20.24	20.19	20.28	20.16	20.15	20.08	19.95	19.87	19.98	0.36

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	21.0	21.0	0.3	0.1	0.6

Remark The uncertainty is not combine uniformity of the air chamber

This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

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Certificate of Calibration

Certificate No. : 67-420044-2

Page : 1 of 2

Submitted by : HVE Co., Ltd.

603 Soi Jarunsanitwong 46 Jarunsanitwong Road, Bangyeekun, Bangplad, Bangkok 10700

Equipment : pH Meter with electrode

pH meter

Manufacturer : Hanna

Model : HI 2211

Range : N/A pH

Resolution : 0.01 pH

Serial No. : 08376721

ID No. : N/A

Electrode

Model : HI 1131

Serial No. : 084809EN

Environment : On site calibration was carried out at the Laboratory, HVE Co., Ltd.

Ambient Temperature : (25.0 to 26.0)° C

Relative Humidity : (40 to 45) %

Date of Received : 18 April 2024

Date of Calibration : 18 April 2024

Date of Issue : 19 April 2024

Calibrated by : Permpon Chanpu

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

Reference Standard Instruments : This certification is traceable to the International System of Units

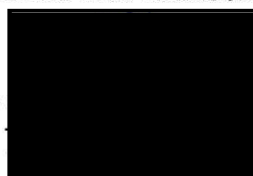
1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
400005	SG-E-00307/66	23 Aug 2025	National Institute of Metrology Thailand (NIMT)

2. Certified Reference Material (CRM)

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61293328	944535	27 Nov 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61281486	944537	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.997	61281073	944536	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by



Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-420044-2

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement
pH meter

Performing standard curve by Multiproduct Calibrator at pH (4,7) and (7,10)

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7	177.4800	4	4.00	177.3	0.2	0.12
	0.0000	7	7.00	0.0	0.0	0.086
7,10	0.0000	7	7.00	0.0	0.0	0.086
	-177.4800	10	10.00	-177.4	-0.1	0.12

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7) and (7,10)

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7	4.008	4.01	0.00	0.010
	6.986	7.01	-0.02	0.011
7, 10	6.986	7.01	-0.02	0.011
	9.997	10.01	-0.01	0.014

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurment was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400222-2

Page : 1 of 2

Submitted by : HVE Co.,Ltd.

603 Soi Jarunsanitwong 46 Jarunsanitwong Road, Bangyeekun Bangplad Bangkok 10700

Equipment : Digital Thermometer with Thermistor Probe (Temp pH)
Temperature Indicator

Manufacturer : Hanna

Model : HI 2211

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 08376721

ID No. : N/A

Thermistor Probe

Model : N/A

Sheath Material : Stainless

Diameter : 3.5 mm.

Length : 100 mm.

Serial No. : N/A

ID No. : 08376721

Environment : On site calibration was carried out at the Laboratory, HVE Co., Ltd.

Ambient Temperature : (25.0 to 26.0) °C

Relative Humidity : (40 to 45) %

Line Voltage : (229.0 to 230.0) VAC

Date of Received : 18 April 2024

Date of Calibration : 18 April 2024

Date of Issue : 19 April 2024

Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400002	TT-0074-22	20 Jun 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400033	24E633	21 Feb 2026	National Institute of Metrology Thailand (NIMT)

Approved by

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400222-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
100	25.002	24.8	0.2	0.19

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

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ABJ





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000 FAX. 0-2719-9484

Cert.No.: 24TW74

Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : Digicon
Model : DO-552SD
Serial No. : AG.35318
ID No. : -
Received Date : 05 April 2024
Test Date : 09 April 2024
Reference : 2404-0175DN-1
Submitted by : HVE Co.,Ltd
603 Soi Jarransanitwong 46, Jarransanitwong Road,
Bang Yi Khan, Bang Phlat Bangkok 10700
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirithean
Approved by : 
() Unnopphol Harachai
(✓) Ponpan Paipim
() Saithip Meangmai
Issue Date : 10 April 2024



Cert.No.: 24TW74

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	23MM405	16 July 2024

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 07-07

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	8.2	0.045

This report was certified only for the instrument we tested. It is allowable to use for study
Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced
other in full, without written approval of the laboratory

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BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.
CALIBRATION LABORATORY

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E-mail: bkk@becthai.com Website: www.becthai.com



Certificate No. : CAL-23-754

Page : 1 of 4

CERTIFICATE OF CALIBRATION

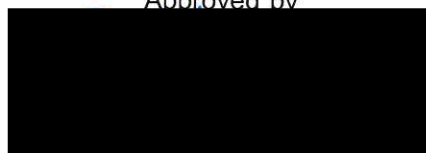
Equipment	:	Spectrophotometer
Manufacturer	:	Thermo Scientific
Model	:	Genesys 10S UV-VIS
Serial No.	:	2L9Q310003
ID No.	:	071
Customer	:	HVE CO., Ltd.
	:	603 Soi Jarunsanitwong 46, Jarunsanitwong Road,
	:	Bangyeekun, Bangplad, Bangkok 10700
Location	:	แผนกน้ำบริโภค
Date of Receipt	:	21 November 2023
Date of Calibration	:	21 November 2023
Date of Issue	:	21 November 2023
Ambient Temperature	:	(25±10) °C
Relative Humidity	:	(60±20) %
Condition As-Received	:	Used Item

Calibrated by



Calibration Engineer

Approved by



Calibration Manager

The reported expanded uncertainty of measurement was based on a combined standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

Indicated values are valid for the state of the Spectrophotometer at the time of calibration only.



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Certificate No. : CAL-23-754

Page : 2 of 4

CALIBRATION REPORT

Conditions of this result of calibration

1. Reference Standard Material :

<u>Material</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert.No.</u>	<u>Due date</u>
Holmium Glass Filter	RM-HG	24563	109211	13 Feb 25
Didymium Glass Filter	RM-DG	24562	109212	13 Feb 25
Neutral Density Filter	RM-1N2N3N	24568	109249	14 Feb 25
Potassium Dichromate Solution	RM-06	24567	109222	13 Feb 25

2. Traceability : This certification is traceable to the International System of Unit maintained at;

The Starna Scientific Ltd. Accredited Calibration Laboratory No. 0659.

3. Method of calibration :

The calibration procedure was carried out according to ASTM E275-08 (2022) and ASTM E925-09 (2014).

4. Result of calibration :

(☒) without adjustment

(☐) after adjustment

5. Equipment Specifications:

Spectral Bandwidth :	1.8	nm
Data Interval :	0.1	nm
Scan Speed :	Slow	nm/min



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Certificate No. : CAL-23-754

Page : 3 of 4

CALIBRATION REPORT

Wavelength Calibration

Certified Values of Reference Material (nm)	Nominal Value (nm)	UUC*Reading (nm)	Error (nm)	Uncertainty of Measurement ($\pm$ nm)
361.00	361.00	360.7	-0.30	0.13
536.66	536.66	536.7	0.04	0.13
879.27	879.27	879.8	0.53	0.13

Photometric Calibration for Visible

Wavelength (nm)	Certified Values of Reference Material (A)	UUC* Reading (A)	Error (A)	Uncertainty of Measurement ($\pm$ A)
420.0	Zero	0.000	0.0000	0.0028
	0.5835	0.585	0.0015	0.0044
	0.725	0.725	0.0000	0.0040
	1.0367	1.037	0.0003	0.0039
440.0	Zero	0.000	0.0000	0.0028
	0.5662	0.567	0.0008	0.0042
	0.7106	0.710	-0.0006	0.0037
	1.0159	1.016	0.0001	0.0037
465.0	Zero	0.000	0.0000	0.0028
	0.5257	0.527	0.0013	0.0044
	0.6682	0.668	-0.0002	0.0039
	0.9547	0.954	-0.0007	0.0034
546.1	Zero	0.000	0.0000	0.0028
	0.5226	0.523	0.0004	0.0036
	0.6939	0.693	-0.0009	0.0039
	0.9919	0.991	-0.0009	0.0032
590.0	Zero	0.000	0.0000	0.0028
	0.5567	0.556	-0.0007	0.0035
	0.7502	0.748	-0.0022	0.0037
	1.0732	1.071	-0.0022	0.0033
635.0	Zero	0.000	0.0000	0.0028
	0.5643	0.563	-0.0013	0.0035
	0.7299	0.728	-0.0019	0.0038
	1.0437	1.042	-0.0017	0.0034

Remark : Each individual filter is measured against the empty filter holder (blank) used to zero the Spectrophotometer.

Note:

UUC* : Unit Under Calibration



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Page : 4 of 4

CALIBRATION REPORT

Photometric Calibration for UV

Wavelength (nm)	Certified Values of Reference Material (A)	UUC* Reading (A)	Error (A)	Uncertainty of Measurement ($\pm$ A)
235.0	Zero	0.000	0.0000	0.0050
	0.7385	0.735	-0.0035	0.0076
257.0	Zero	0.000	0.0000	0.0050
	0.8556	0.851	-0.0046	0.0077
313.0	Zero	0.000	0.0000	0.0050
	0.2882	0.288	-0.0002	0.0059
350.0	Zero	0.000	0.0000	0.0050
	0.6346	0.631	-0.0036	0.0069

Remark : The Potassium Dichromate Filled cells are measured against a Perchloric acid blank.

Note:

UUC* : Unit Under Calibration

- End of Report -